'A METHOD OF TRANSMITTING SIGNALING DATA

        The present invention relates to a method of
transmitting signaling data. It can be used in the
telephony art in particular to interconnect two
exchanges, in particular two private exchanges.

        Constituting transmission channels involving, in
principle, physically, temporally or functionally
reserving means for sending data and physically,
temporally or functionally reserving complementary means
for sending signaling signals is known in the telephony
art. Signaling signals, or signaling in general,
organize(s) the transfer of data on the other means.
Thus data channels or signaling channels can be
physically different channels, pairs of telephone wires
in a multi-pair cable. They can equally be frequency
allocations in an overall frequency band. Finally, from
the functional point of view, they can be messages sent
on a channel but whose destination is sometimes one
person and sometimes another person, depending on
signaling data contained in the message.

        It is usual to distinguish between homogeneous
access and hybrid access. With homogeneous access the
channels used for data are of the same type as the
channels used to send signaling. The invention is more
particularly directed to hybrid access in which the
channel types are different, although the invention can
equally be adapted to suit homogeneous access.

        If two exchanges are interconnected, it is necessary
for them to use identical transaction protocols on their
common communication channels. To this end, the ISDN
standard relating to integrated services digital networks
(ISDN) defines a protocol offering relatively high
performance. Consequently, since the introduction of the
ISDN standard, new exchanges have conformed to it.

        However, in extant public networks in particular,
some communication channels do not conform to the ISDN
standard. This is because they were designed a long time

'ago, because their objectives are different to those
addressed by the standard, or because their modes of use
are then more efficient. Examples of such networks are
Ethernet networks and QSig-GF networks.

5   A problem therefore arises because the equipment is
not homogeneous, comprising exchanges that comply with
the ISDN standard, on the one hand, and exchanges that do
not comply with it, on the other hand. The problem lies
in the fact that the ISDN standard defines a protocol for

10   sending signaling signals relating to telephone calls to
be set up or modified. In practice it is the definition
of the protocol which causes the problem. It cannot be
implemented in networks which do not conform to the ISDN
standard. The ISDN protocol provides service access

15   point identifier messages, comprising SAPI S messages for
signaling and SAPI P messages for sending packets. When
the exchange equipment is manufactured the problem
therefore arises of the inability of the exchange to
route calls conforming to its standardized protocol over

20   a network of a type other that conforming to the
standard, and in particular a network which does not
accept signaling messages.

       The invention solves this problem by converting the
signaling data produced by the exchange in the standard

25   ISDN format into signaling data in a format accepted by
the channel. The format accepted by the channel includes
the addition to the signaling data of information
indicating that it is signaling data. Because the
channel that is to be used does not make any distinction,

30   a protocol that the invention determines in advance is
used to advise it that the signaling messages are in fact
signaling messages.

       In more concrete terms, given the random nature of
the requirement to send signaling messages (which are

35   sent only when a call is set up between two parties or if
the call conditions are modified), it would appear
necessary to have a channel open at all times to convey

'the signaling messages. However, a channel that is open at all times consumes a great amount of resources, in particular if it does not carry a great amount of information. One kind of channel that is open at all

5 times well known to the skilled person is an Ethernet network. An Ethernet network is designed to route packets of information fed to it. However, although it corresponds effectively to the requirements stated by exchange proprietors, from this point of view of

10 permanent availability, an Ethernet network does not conform to the ISDN standard. The treatment to encapsulate data in order to transport it on Ethernet networks uses software that conforms to the UDP-IP (User Datagram Protocol - Internet Protocol) standard, for

15 example. The UDP-IP standard is not structured like the ISDN standard and is not compatible with it. In particular, with the UDP-IP standard, the sending of information packets is not assured and their order of arrival is even less assured.

20 To solve this problem, the invention adds information representing the order of the packets to signaling packets sent over an Ethernet network. When a packet is received, an acknowledgment is sent to the sender. The acknowledgment includes the number of the

25 last packet received. This tells the sender which information packets have not been received and must be sent again.

In another example, the channel used to send the signaling messages is a standard QSig-GF channel, which

30 does not conform to the ISDN standard either. Unlike an Ethernet network, which does not have any signaling channel at all, standard QSig-GF networks include signaling channels. However, their signaling channels are capable of carrying only SAPI S messages, not SAPI P

35 messages. Consequently, none of the SAPI P information generated by the exchanges in the context of ISDN calls can be routed.

In this case, the invention exploits the existence in the QSig-GF protocol of a particular kind of availability referred to as a "FACILITY" message and enabling any type of information to be transmitted within
5   a FACILITY message, whilst still complying with a form of encapsulation specific to the QSig-GF standard. The invention therefore starts by setting up a call with no B channel between the two exchanges connected by a QSig-GF link. This call with no B channel can then be used to
10   enable the two exchanges to interchange FACILITY messages relating to the call on the D channel and therefore to encapsulate signaling messages with a header corresponding to the QSig-GF standard.

The invention therefore provides a method of
15   transmitting signaling data which relates to telephone access conforming to the ISDN standard and is transmitted on a channel that conforms to another standard and does not conform to the ISDN standard, which method is characterized in that it includes the following steps:
20   - a channel is set up once and for all that conforms to another standard and does not conform to the ISDN standard,
           - signaling data in the format of the ISDN standard is converted into data in a format accepted by the
25   channel conforming to the other standard,
           - the signaling data converted in this way is sent, and
           - when it is received, the signaling data is converted reciprocally into signaling data to the ISDN
30   standard format.

The invention will be better understood after reading the following description and examining the accompanying drawing. The drawing is provided entirely by way of non-limiting example of the invention. In the
35   drawing:
           - Figure 1 is a diagram showing the implementation of the method according to the invention when the other

'standard is the USDP-IP standard, and

- Figure 2 is a diagram of the same type as Figure 1
when the other standard is the QSig-GF standard.

Figure 1 illustrates a method according to the
invention. It shows a private automatic branch exchange
1 (PABX1) which is connected to telephone equipment units
2 and 3. For simplicity it may be assumed that the units
2 and 3 are telephones or microcomputers. The design of
the units 2 and 3 conforms to the ISDN standard, as does
that of the exchange 1. In accordance with the ISDN
standard, information which has a signaling part 4 and a
message content part 5 is generated for all connections
of a unit 2 to the exchange 1 or to another unit 3. In
accordance with the ISDN standard, the signaling and
message content parts 4 and 5 of the information are
processed by different circuits. The circuits which
process the signaling part 4 of the information have the
particular object of setting up all the switchpaths
needed to route messages between the units 2 and 3.

The aim the invention is to connect the exchange 1
to another exchange 6 of the same type when the link 7
for connecting the two exchanges is of a different type
and operates in accordance with a protocol other than
that of the ISDN standard. In the example shown in
Figure 1, the link 7 uses an Internet protocol conforming
to the UDP-IP standard. More generally, the link
includes channels (not shown) for transmitting the
message content parts 5 and a channel to the UDP-IP
standard for transmitting the signaling parts 4 relating
to the message content parts 5.

The invention converts the signaling information 4,
which consists of data in the format of the ISDN
standard, into a signaling message 8 in a format accepted
by the channel 7 to the other standard. For example,
signaling messages 4, 41, 42 and 43 can be encapsulated
in UDP-IP packets 9 to 12. The packets 9 to 12 are
encapsulated by control bits conforming to the UDP-IP

'standard. Under the UDP-IP standard, one message is inserted into each UDP-IP packet. There cannot be more than one signaling message in a UDP-IP packet. Moreover, a signaling message is not divided into several parts.

5   According to the invention, the messages 8 encapsulated in this way are sent on the channel 7 and received in the exchange 6. In the exchange 6 the received messages 8 are converted into information of the signaling part 4 type conforming to the ISDN standard which can then be

10   processed in the exchange 6 to enable the units 2 and 3 to be connected to other units 13 and 14 (possibly on another channel).

Because the UDP-IP protocol involves the risk of loss of packets, and most importantly the risk of the

15   order of the packets 9 to 12 being reversed, an improvement to the invention modifies the message 8 formatted to the UDP-IP standard by adding packet order information to it. In the structure of the message 8, the construction of the successive data blocks (blocks 9

20   to 12) is modified. Packet order information is added to each block. The packet order information occupies one byte, for example, covering packet numbers from 0 to 255. The packet number is then incorporated into the message 8 in a respective area 15 to 18 placed before or after each

25   block 9 to 12. The packet number forms an integral part of each send block (i.e. each block to be sent). In this case, in accordance with the invention, it is the send block consisting of a block 9 and its number 15 that must conform to the UDP-IP standard. The successive send

30   blocks are then sent to the other exchange 6. The latter receives them and sends back to the exchange 1 an acknowledgment essentially representing the number of the last send block that has been received and corresponding to a continuous stream of send packets that have been

35   received.

In one example, this sending is effected by means of a circular memory 19 which has four locations for loading

four send blocks, for example. Thus send blocks 1, 2, 3 and 4 are loaded. The four send blocks are then sent in turn to the exchange 6 via the channel 7. The memory 19 can be loaded as and when the blocks are sent. The

5 exchange 6 may then, for example, depending on transmission conditions that apply, determine that it has received blocks 1 and 2, that it has not received block 3 and that it has received block 4. In this case, the exchange 6 sends an acknowledgment to the exchange 1

10 indicating the block number 2 (n=2). This means that the blocks have been received continuously up to block 2.

In this case the exchange 1 can load the circular memory 19 with subsequent blocks 5 and 6 instead of the blocks 1 and 2 already received. The content of the

15 memory 19 will then consist of the blocks 3, 4, 5 and 6. Accordingly, when the exchange 1 loads the circular memory 19 with the blocks 5 and 6, only these two blocks are sent. After block 6 is sent, it is necessary to send block 3 again if no acknowledgment citing a block number

20 greater than or equal to 3 has been received after a time-out. A block is sent when it is present in the circular memory and the block already sent has not been acknowledged after a time-out. In this way the block 3 is sent, and possibly the block 4. Note that the block 4

25 can be sent a second time, even though it has already been received (after it was sent the first time), because the time-out can end before the acknowledgment for block 3 is received (or even for block 6, as both these blocks have been sent). Thus the circular memory 19 is loaded

30 and blocks are sent as and when acknowledgments are received. If no acknowledgment is received after a given time-out all of the content of the circular memory is sent again. Thus, if no other acknowledgment has been received since the acknowledgment citing block number 2,

35 blocks 3, 4, 5 and 6 can be sent a second time. It is also possible for block 3, which has not previously been received in time, to reach the exchange 6 late, although

'by then the exchange has already received block 3 (after it was sent the second time). In this case, the block that was sent is merely received twice over. It is set aside and is not processed a second time.

5   According to another improvement to the invention, the functionality of the channel 7 is tested continuously by sending surveillance messages 20 which simply take the form of a signaling block 1 that is sent at a period adopted for testing the functionality of the channel 7.

10   For example, it can be sent approximately every 15 seconds. If the acknowledgment 1 which concerns it is received, the channel is deemed to be functional. If not, after a particular number of attempts, the channel 7 is declared deficient and an alert procedure is

15   undertaken. The same applies if an expected block n is never received.

Given that only one byte is used to convey the block order information, the number of a send block cannot be greater than 255. This is not a problem because if the

20   number of blocks is greater than 255 it is sufficient to start counting again from 0 when 255 is reached. In this case, the circular memory need only include a number of blocks significantly less than 256.

Figure 2 shows similar elements to Figure 1, but for

25   the QSig-GF protocol, which does not conform to the ISDN standard either. The figure also shows the exchange 1 in a little more detail. The exchange includes a microprocessor 21 connected by a bus 22 to the units 2-3, a QSig-GF format interface 23 and a program memory 24

30   containing in particular a program for formatting messages to the format conforming to the QSig-GF standard. The same applies to Figure 1 with regard to the UDP-IP standard. The program 24 provides a particular mode of use including a call request

35   procedure, a connection procedure, a procedure for sending free messages (FACILITY messages) and a disconnection procedure. In accordance with the

'invention, the microprocessor 21 launches a working
session of the interface 23 so that it calls the exchange
6 by setting up a call with no B·channel, connects to it
and remains connected to it. Automatic disconnection

5   time-outs are eliminated if necessary. The call set up
with no B channel is set up via the D channel of the
QSig-GF bundle. It is referred to as a support call. In
accordance with the invention, FACILITY messages are sent
on the D channel by encapsulating the ISDN signaling

10   (SAPI S and SAPI P messages) in FACILITY messages carried
by the support call. FACILITY messages are exchanged
between the exchange 1 and the exchange 6 transparently.
The transfer can continue for as long as the support call
is active.

15   In this mode, messages to be sent on the QSig-GF
format channel must essentially include a header 25. In
practice, the header 25 occupies one byte. This first
byte is a facility information element (EI FACILITY). It
contains four types of information. A first type of

20   information advises the length of the facility message.
The header also contains a protocol discriminator,
references of the support call request and the message
type. In fact, in this instance, the message type is
always the FACILITY type.

25   An area 26 of the FACILITY message following on from
the header area 25 contains a header specific to the
message. In a subsequent area 27, the nature of the
message (SAPI S or SAPI P) is indicated by a code
corresponding to S or P. Signaling messages 4 are sent

30   in a subsequent free area 28, and consist of the
information previously referred to. If the resulting
message conforming to the QSig-GF protocol is longer than
the 128 bytes available in a normal FACILITY message
frame (from which the headers and areas 26 and 27 must be

35   deducted, incidentally), the length indicated in the part
25 must include an indication that the FACILITY message
continues beyond the 128 bytes. In this case, the

'message includes a part 29 and a part 30. The part 29 is
identical to the part 26. The part 30 is substituted for
the indication relating to the nature of the message
(SAPI S or SAPI P). However, it includes in practice an
5   indicator of the order of the length extension (the
additional length over and above the normal length). In
this example, the part 30 could contain information A,
then information B, and so on; depending on the length of
the signaling message to be transmitted, length
10   information 25 is provided and markers A, B are inserted
into the message.

       The signaling data to be transmitted in accordance
with the invention comprises flow control data, security
data and, essentially, message scheduling data.
15   According to the invention, the information part 5 can be
sent between the exchanges 1 and 2 via other channels, in
a manner that is known or unknown. The units 2 and 3 can
also be connected to the units 13 and 14 by UDP-IP or
QSig-GF channels. The channels, although of the same
20   type as the channels used to transmit signaling, are
nevertheless different. Thus signaling and messages are
not sent at the same time on the same channel.